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The Strange Case of Snowy 2.0

(as seen through the prism of a nifty NEO chart)

Hugh Bannister, Chairman and CEO, IES

Introduction

The National Electricity Market (NEM) clocked up its 20th year last December, with nary a moment to celebrate or note it in the media. However, Ben Skinner at the Australian Energy Council (AEC) did point me to a nice nostalgic piece he wrote[1] which I commend as a good read. And Ben is right; the NEM was innovative and effective in its time and can be again, if the same focus can be brought to bear on the issues of the day.

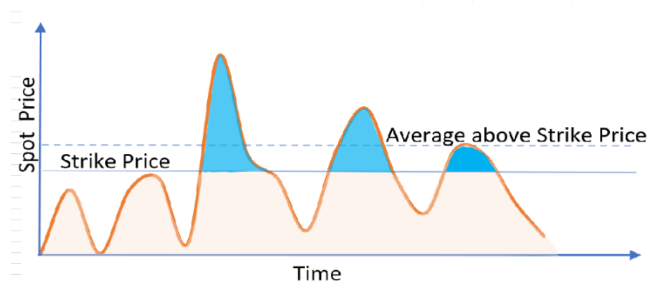
In earlier Insider pieces I have also traversed NEM history from time-to-time, sometimes with a focus on NEM wholesale (spot) prices. In this article I will focus on a nifty chart available in NEO called a premium curve. It's an enlightening way to relate spot prices to underlying long run costs. I'll take a quick gallop over NEM price history from this perspective, finishing with a look over the strange case of Snowy 2.0.

Premium Curves

For me, premium curves sit near the top the list of useful NEM charts. For those not familiar with them, I'll go into more detail on what they are and what they can reveal.

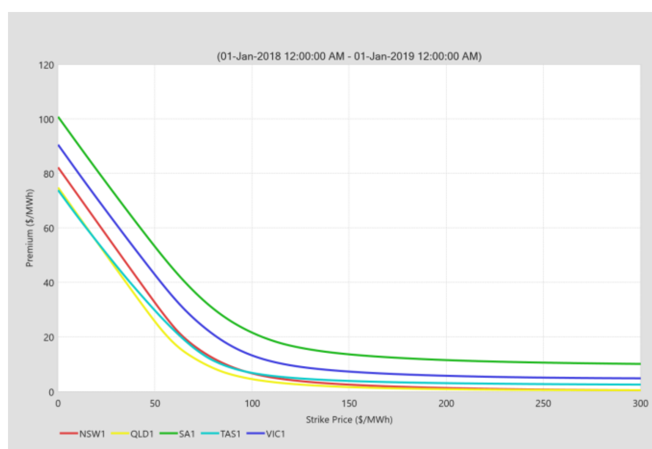
A premium curve plots the ex post value (premium) of a notional cap contract over a range of strike prices, for some nominated period. A single year is a useful period to analyse. In the stylised price curve in Figure 1 following, the blue area is the payout for the strike price shown. We can express this as an average over the period, or premium, shown by the dotted line above the strike price. The premium curve is a plot of this value as the strike price varies.

Figure 1: Calculation of Premium for a Given Strike Price



An example of this plot is shown in the chart of Figure 2, where the period plotted spans the whole year of 2018 and there is a separate plot shown for each NEM region.

Figure 2: Premium Curves for 2018 – All Regions



[1] https://www.energycouncil.com.au/analysis/happy-20th-birthday-national-electricity-market/

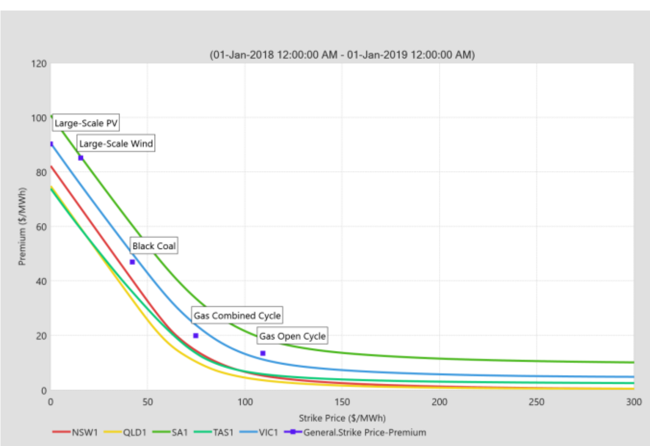
We can immediately observe a few things from this chart:

- The x axis can be expressed as total dollars over the period, as a dollar rate or as dollars per megawatt per hour, the same units as energy price $/MWh. I find $/MWh the most useful, as it normalises the shape of the chart. This unit is used in the charts in this article.
- Absent significant incidents of negative prices, the intercept with the vertical axis at a strike price of zero is at or near the time average price over the period.
- With x and y axes expressed in the same units, the downward slope for the vertical axis is initially minus 1, evident in the example shown.
- The asymptote at around a strike price of $300 represents the value in the market of strike prices above $300/MWh, the fat tail of the price distribution.
- The plots for multiple regions give a good way to compare outcomes between regions.

In the example shown we see immediately that average prices cluster around $90/MWh while the premium at a $300 strike price is a lot more variable; for example, we can see immediately that the slightly higher SA price was the direct result of some very high priced episodes – when the link inwards was constrained.

We can also use this chart directly to assess quickly how the market is travelling with respect to investment in various types of plant. If we interpret strike price as a variable energy cost (mostly fuel) and the premium as an hourly figure of desired fixed cost recovery, we can plot typical long run costs of generation technologies as points on this chart. This gives us the chart of Figure 3.

Figure 3: Premium Curves with Costs for 2018 – All Regions



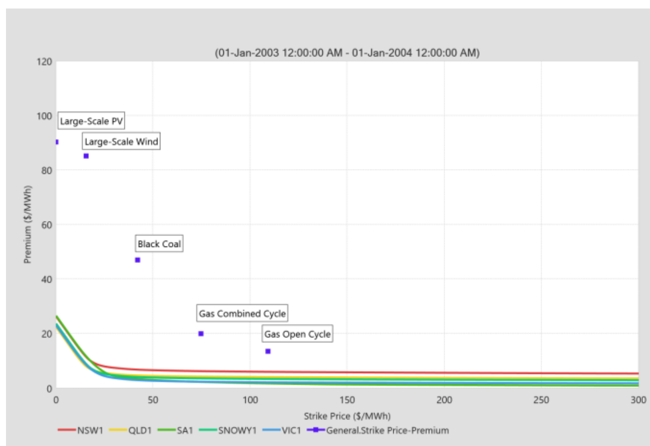
The costs are taken from AEMO planning data and are indicative only. Note that wind and solar are quite competitive at current gas prices but the chart says nothing about the ability of plant to be dispatched at will. Gas and coal plants come closest to that ideal.

We can see from this plot that most technologies shown would earn in excess of their fixed costs, at least in some regions, if dispatched efficiently. This suggests either a potential need for more plant or interconnection in some regions, notably SA, or, possibly, that market power is being exercised.

The previous plot is by no means typical of outcomes over the past 20 years. Take a look at the plot for 2003 in Figure 4, which has the same scales as the previous one. Even though technology costs would have been less than those shown, this is clearly a period when excess capacity and competition had driven prices to rock bottom.

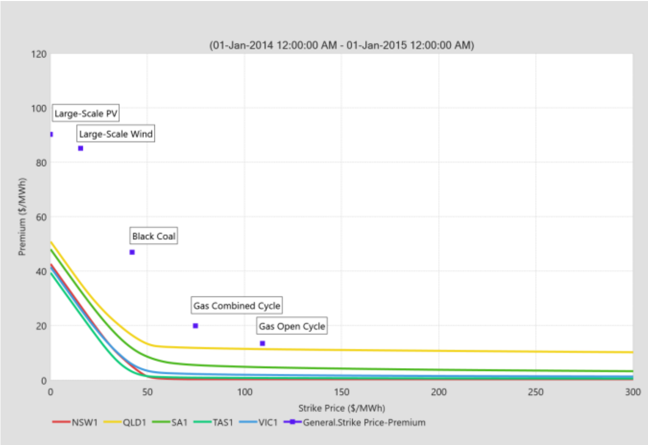
What is rock bottom? If there is surplus capacity, plant will not necessarily shut down. It will continue to run so long as fixed cost recovery is sufficient to cover fixed operating costs. Capital costs are sunk. Such a consumer paradise is only going to last as long as a capacity surplus persists.

Figure 4: Premium Curves with Costs for 2003 – All Regions



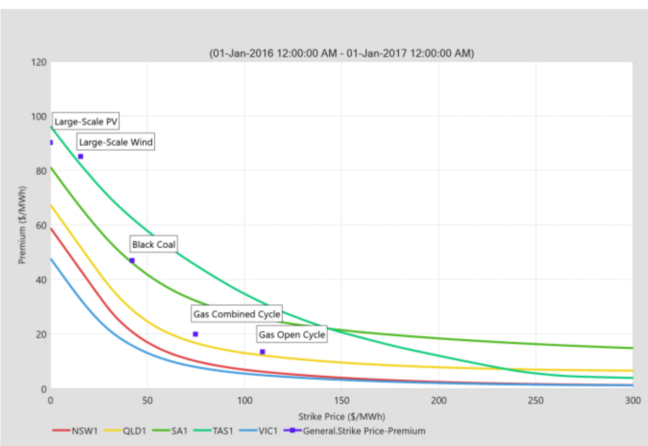
By 2014, prices had increased but were still relatively as indicated in Figure 5 following . The figure continues to show that market prices would not deliver sufficient surpluses over operating costs to justify new investment.

Figure 5: Premium Curves with Costs for 2014 – All Regions



By 2016 (shown in Figure 6), we can see the price impact of the 2016 Basslink outage and the closure of Northern Power Station in South Australia. With the closure of Hazelwood the following year and the jump in gas exports and prices, we get the current pattern of prices as indicated by the earlier chart in Figure 3. Spare capacity has been used up and this pattern now looks pretty much the long run equilibrium price under current gas price conditions.

Figure 6: Premium Curves with Costs for 2016 – All Regions



Why have wholesale prices increased so dramatically? Market Power was likely exercised in how we got here (notably with the timing of Hazelwood closure), but not so much now. Who needs to exercise market power as a generator when gas prices and tight supply can do it for you? To summarise, two main factors have been at work:

- The surplus capacity that has been present since market start is now used up. This was always going to happen and it took a lot longer than people thought way back in 1998 at NEM start.
- Gas prices; as a country we consciously chose massive gas exports and export parity pricing, so we now reap what we have sown. Gas price escalation affects not only electricity prices but also slowly strangles domestic energy-intensive manufacturing of all kinds.

Snowy 2.0

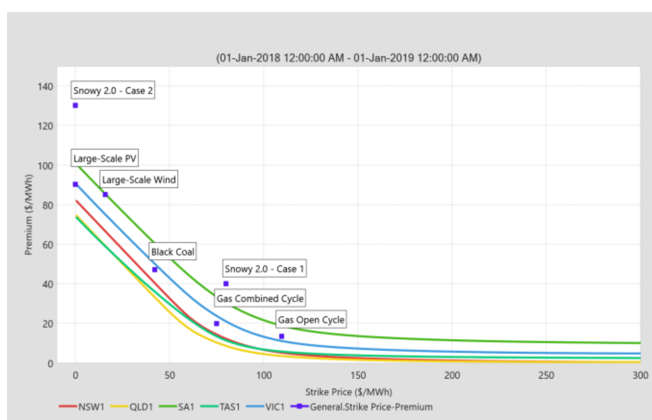
As an exercise for the student I have tried to analyse how a pumped storage hydro scheme such as the proposed Snowy 2.0 would appear on a premium curve chart.

Pumped storage hydro has a well-defined (but uncertain) fixed cost associated with it, but what is the strike price? It is essentially the variable cost of production, or pumping cost. To get an approximate figure, we consult the typical lower bound on prices in recent years at around $60/MWh.

However, we can't use this number directly as pumping and generation are not 100% efficient. A reasonable cycle efficiency for Snowy 2.0 with its very long tunnels is 75%, which grosses up our pumping cost estimate to $80/MWh.

For a nominal 2,000MW plant costing $5billion with a $2billion cost of transmission upgrades attached to it, and at a discount rate of 10% suitable for a large and potentially risky project, the capital cost can be taken as $40/MWh. We take this as the strike price, near enough, although likely to be an underestimate in practice, for many reasons. We plot this on the 2018 premium curves to get Figure 7. This Snowy case is labelled as Snowy 2.0 – Case 1. In this figure, note that the gas combined cycle labels are displaced upwards a little because of space limitations.

Figure 7: Premium Curves for 2018 – Snowy 2.0 Cases



We can see that Snowy 2.0 Case 1 looks like an outlier on these assumptions. The plotted points are generally supporting average prices around $80-$100/MWh. Gas plant can support the renewable options at these prices. If we focus on the lower end of the curves, we can see that Queensland is currently benefiting from its portfolio of legacy coal plant, at least in terms of wholesale prices.

We can make different assumptions about the cost of Snowy pumping. For example, we could argue that Snowy 2.0 is intended to use renewables for its pumping, so the strike price should be taken as zero. In this case we have to assign at least some of the capital cost of the renewables to Snowy 2.0. But how much?

If Snowy 2.0 operates at a capacity factor of, say, 30% (very high but probably necessary if it is to compete with gas combined cycle plant, for example), then the same nominal capacity of wind farms operating at 30% would be needed to support the pumping. However, the available wind (or solar) would be unlikely to correspond with pumping need. Setting aside this small problem, we get the point labelled as Snowy 2.0 Case 2 on the chart of Figure 7. This still makes Snowy 2.0 look like an outlier, even if we vary or relax these assumptions somewhat.

Conclusions

For me, NEO premium curves plotted along with technology points provide a vivid snapshot of major market trends and the drivers behind them. Premium curve processing comes standard with NEO and I commend it to new and old NEO users alike.

What are we to make of my NEO analysis of Snowy 2.0? Of course, I have made many assumptions so it just heightens my interest to find out more. I've looked at what's published and I can't get a great deal of satisfaction from it.

We're told that Snowy 2.0 is viable but from who's perspective? I suspect that, from the point of view of a dominant supplier of peak power, some more capacity under its control is a great idea. It would support a large tranche of intermittent plant and Snowy could also arrange things to give a desired rate of return.

But would it deliver at Angus Taylor's target wholesale price target of $70/MWh, which I presume is a time average? In the short term the large swathe of renewables coming on stream in the next few years should indeed lower prices and a target of $70/MWh may well be in reach for a period. Setting aside the irony of a Coalition relying on renewables to lower prices despite implacable opposition to them in much of its rhetoric, we can run with Lord Keynes' telling maxim that "in the long run we're all dead" and be thankful for the $70/MWh for as long as it lasts.

Looking at the technology points on my premium curves, I can't see anything there that will deliver a $70/MWh outcome in the longer run, and certainly Snowy 2.0 won't help. Eyeballing the technology points, I see a long run outcome more in the vicinity of $90-$100/MWh than $70/MWh, as coal plant retires and we become more reliant on gas. Of course, things could change but we're relying on dumb luck at that point.

It's difficult to see from this vantage point why the Coalition has embraced Snowy 2.0 with such enthusiasm. It's certainly put a dampener on private investment that would support reliability. Perhaps it's seen as a nation building project. If so, can turning the rivers inland be far behind?

It's also hard to see why the environmental/renewables lobby appears to have embraced Snowy 2.0 in the main. Its cost is a dead weight to set against a renewable strategy when there are cheaper, more conventional gas options that would fulfil the same firming function for those occasions when short term storage is insufficient.

CONTACT

Hugh Bannister

+61 (0)2 8622 2210 **+61 (0)411 408 086**

hbannister@iesys.com **www.iesys.com**